

A New Species of the Soft Coral Genus *Eleutherobia* Pütter, 1900, (Octocorallia: Alcyoniidae) from South Africa

by

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The alcyoniid soft coral genus *Eleutherobia* was previously known to contain sixteen valid species, distributed from southern Africa to the south central Pacific Ocean. A new species is here described from the KwaZulu-Natal coast of South Africa, thereby making a total of seventeen species, with four of these restricted to southern Africa. The new taxon is superficially similar to *Eleutherobia rubra* (Brundin, 1896), originally described from Japan, but differs from it and all other species of the genus by a unique complement of sclerite types.

Williams (2000b:159) summarized recent discoveries concerning natural products biochemistry and the soft coral genus *Eleutherobia*. In the same paper, *Eleutherobia zanahoria* was described from the Tonga Islands, thus extending the known geographic range of the genus approximately 3000 km to the southeast into the central South Pacific. Four species of the genus are known from southern Africa, including the new species described below. The other taxa are *Eleutherobia studeri* (J. S. Thomson, 1910), *E. rotifera* (J. S. Thomson, 1910), and *E. aurea* Benayahu and Schleyer, 1995 (Williams 1992a, 2000a, 2000b). Together with thirteen species from the Indo-West Pacific, a total of seventeen species of the genus *Eleutherobia* are presently considered valid. The geographic range of the genus extends from the southeastern fringe of the Atlantic Ocean (Cape Peninsula), around South Africa, through the Indian Ocean, and as far as Japan, Palau, and Tonga in the Pacific Ocean (Fig. 1). A revision, which will add other taxa for southern Africa, is currently in progress by the authors.

METHODS

Material was collected by SCUBA or dredge and preserved in 70% ethanol. Sclerites were isolated using sodium hypochlorite (household bleach). Micrographs and photographs for Figures 2 and 3 were taken using a Nikon Coolpix 990 digital camera, a Nikon SMZ-10 dissecting microscope, and an Olympus CH-2 compound microscope. Scanning electron micrographs were taken using a Leo 1400 Series scanning electron microscope. Sclerites were examined and drawn using an Olympus CH-2 compound microscope with an attached drawing tube. Digital images and plates of photographs, micrographs, and scanning electron micrographs were made using Adobe Photoshop software. The abbreviation used for the South African Museum, Cape Town, is SAM.

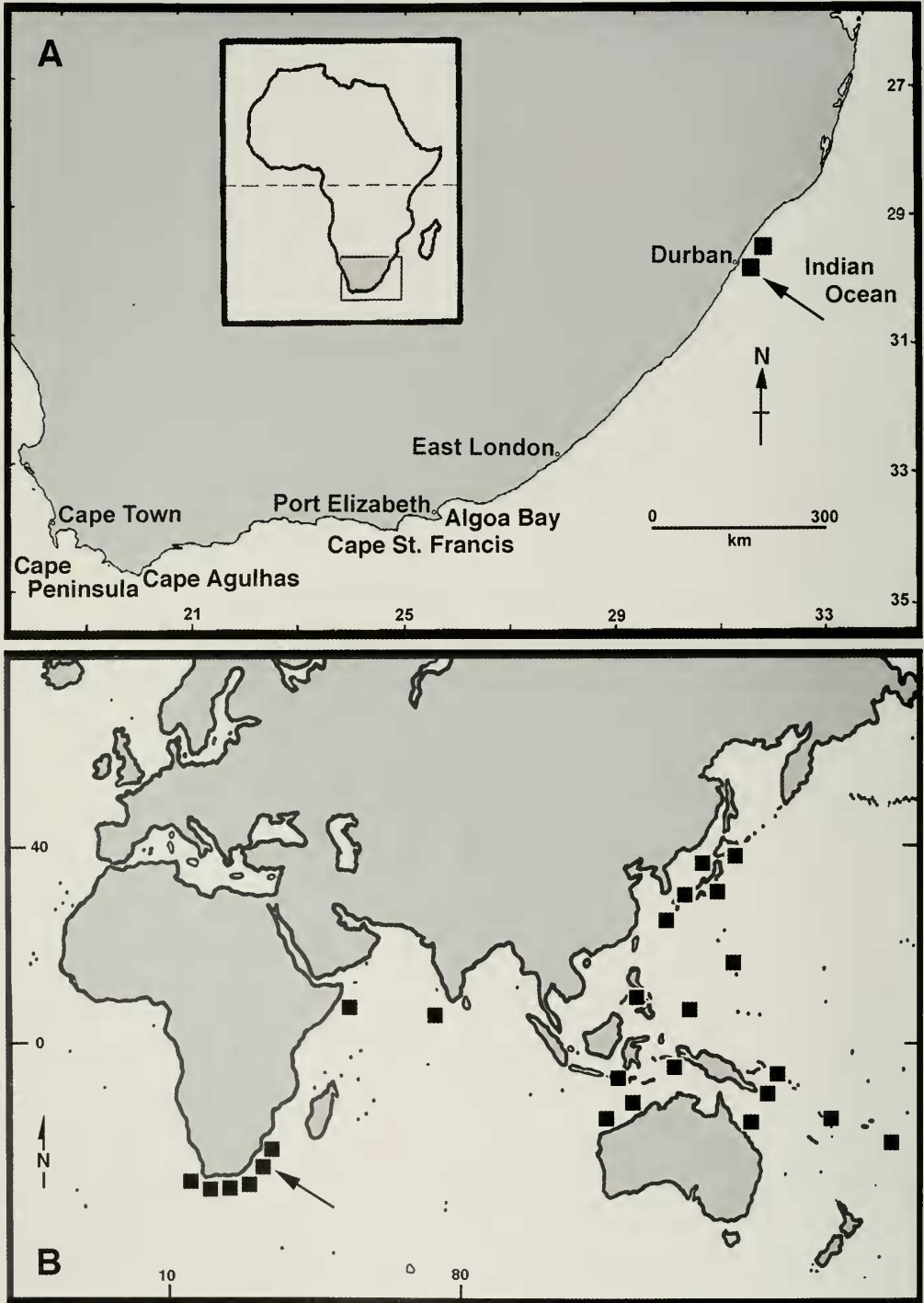


FIGURE 1. A. Map of southern Africa showing collecting stations for *Eleutherobia vinadigitaria* sp. nov. B. Map of the Indo-West Pacific showing geographic distribution of the genus *Eleutherobia*. Arrows show type locality of *Eleutherobia vinadigitaria* sp. nov. Numbers along axes represent degrees of longitude and latitude.

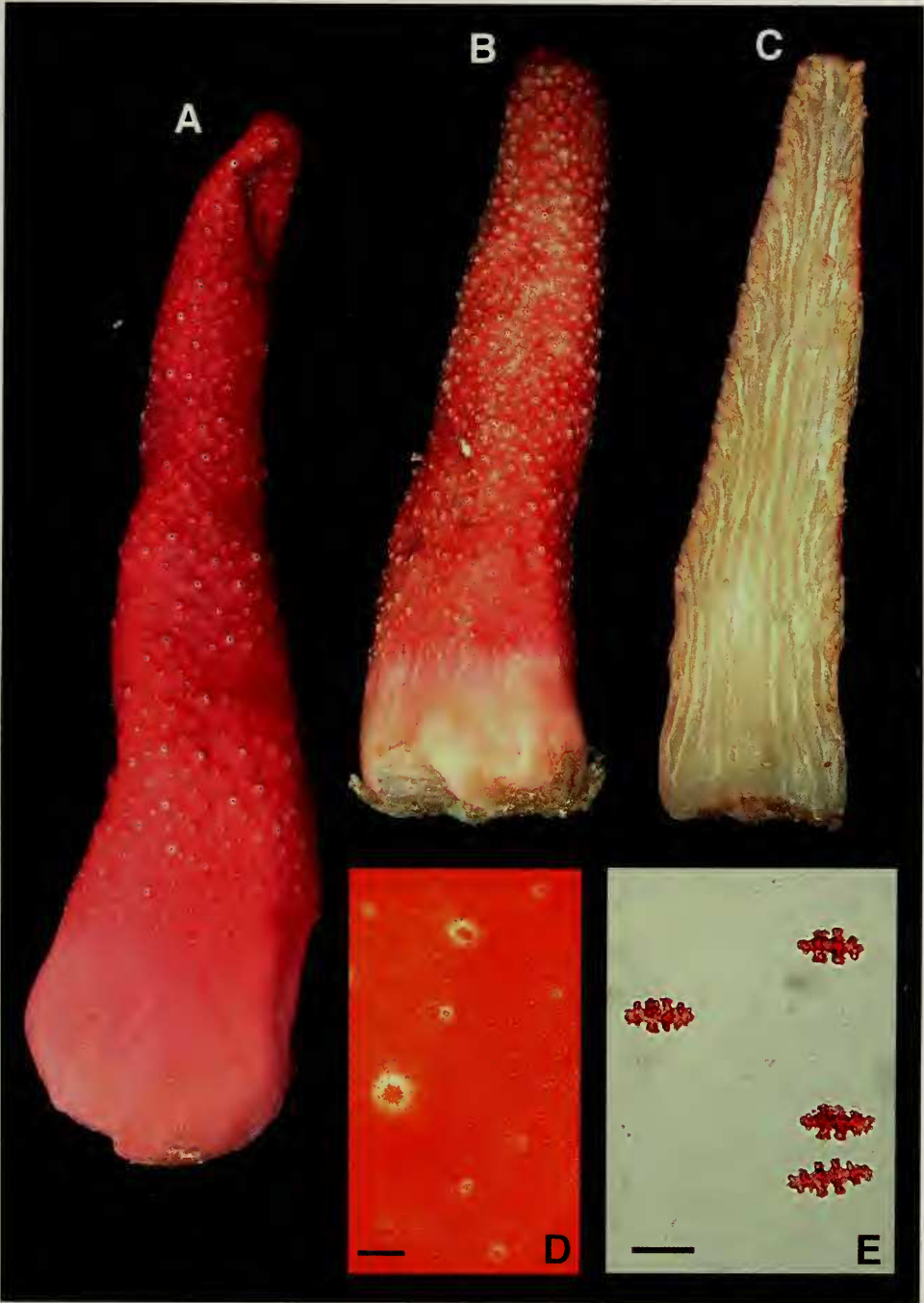


FIGURE 2. *Eleutherobia vinadigitaria* sp. nov. A. Holotype, total length 97 mm. B. Paratype exterior, total length 88 mm. C. Paratype interior, longitudinal section; total length 88 mm. D. Holotype, detail of surface of polyparium showing retracted polyps; scale bar = 0.50 mm. E. Holotype, sclerites from the surface of the polyparium; scale bar = 0.07 mm.

SYSTEMATIC ACCOUNT

Family Alcyoniidae Lamouroux, 1812

Eleutherobia Pütter, 1900*Eleutherobia* Pütter, 1900:449. Verseveldt and Bayer, 1988:27. Williams, 1992a:306. 2000b:160.*Nidalia* (in part): *non* Gray, 1835.*Bellonella* (in part): *non* Gray, 1862.*Metalcyonium* (in part): *non* Pfeffer, 1889.

DIAGNOSIS.—Alcyoniid soft corals with colonies digitiform, finger-shaped, often conical and tapering, rarely multilobate. Polyps monomorphic. Calyces absent, although retracted polyps often form low rounded to conspicuous protuberances. Sclerites mostly derived from radiates although spindles, crosses, barrels, or tuberculate spheroids may also be present. Polyp sclerites often present as eight points, or crown and points, or totally absent. Zooxanthellae absent.

TYPE SPECIES.—*Eleutherobia japonica* Pütter, 1900, by monotypy.

DIVERSITY AND DISTRIBUTION.—Seventeen species of the Indo-West Pacific (southern and eastern Africa to Japan and Tonga).

Eleutherobia vinadigitaria sp. nov.

Figs. 1-10

MATERIAL EXAMINED.—**HOLOTYPE:** SAM-H4877, station number DEEP No. 1, South Africa, KwaZulu-Natal, outer anchorage off Durban Bluff, 52 m depth, 13–14 December 1984, collected by W. R. Liltved with aid of SCUBA, one whole specimen (97 mm in length). **PARATYPE:** SAM-H4878, same data as holotype, one specimen (cut longitudinally into two halves; each half 88 mm in length). **OTHER MATERIAL:** SAM-H792, station number P. F. 11538, South Africa, KwaZulu-Natal, Thukela (Tugela) River Mouth, NW by N 22 1/2 miles, 86 m depth, 29 January 1901, collected by S.S. *Pieter Faure* survey with aid of dredge, one whole specimen (20 mm in length). SAM H-4835, same data as holotype, three whole specimens (18 mm, 72 mm, and 100 mm in length); the latter specimen partly cut transversely, thus partially separating the polypary from the stalk (Fig. 4B).

DIAGNOSIS.—Alcyoniid soft corals with digitiform colony shape, tapering distally to a rounded apex. Stalk conspicuous, comprising 20 to 50% of total colony length. Retracted polyps form moundlike protuberances. Sclerites of the eight polyp wall ridges with longitudinal rows of mostly sparsely-set, elongated, needle-like spindles (up to 0.30 mm long), sometimes arranged more or less in a chevroned fashion. Coenenchymal sclerites restricted to a thin surface layer of the polypary and stalk, primarily radiates and spindles, with a few clubs also present (0.03–0.20 mm in length). Interior sclerites absent. Color of stalk pink; polypary pink, red, or deep wine red. Sclerite color primarily reddish, rarely colorless.

DESCRIPTION OF THE HOLOTYPE.—**Growth form and size.** The wet-preserved holotype is 97 mm in length, and varies from 10 mm in width near the distal tip to 25 mm in width at the base of the stalk. It is finger-shaped, not branched or lobate. The length of the polypary is 77 mm, and comprises 79% of the total colony length, while the stalk is approximately 20 mm long and represents about 21% of the total colony length. The specimen is digitiform and tapers markedly from the holdfast to the distal terminus, which is conspicuously rounded (Fig. 2A).

Polyps. The polyps are tightly retracted in the available specimens, including the holotype. A small portion of the surface coenenchyme of the holotype was cut away to expose the retracted polyps. Many of the exposed polyps contain several mature gonads in their gastric cavities. These are pale yellow in color and mostly vary from 0.2–0.4 mm in diameter. The size of retracted polyps on the sur-

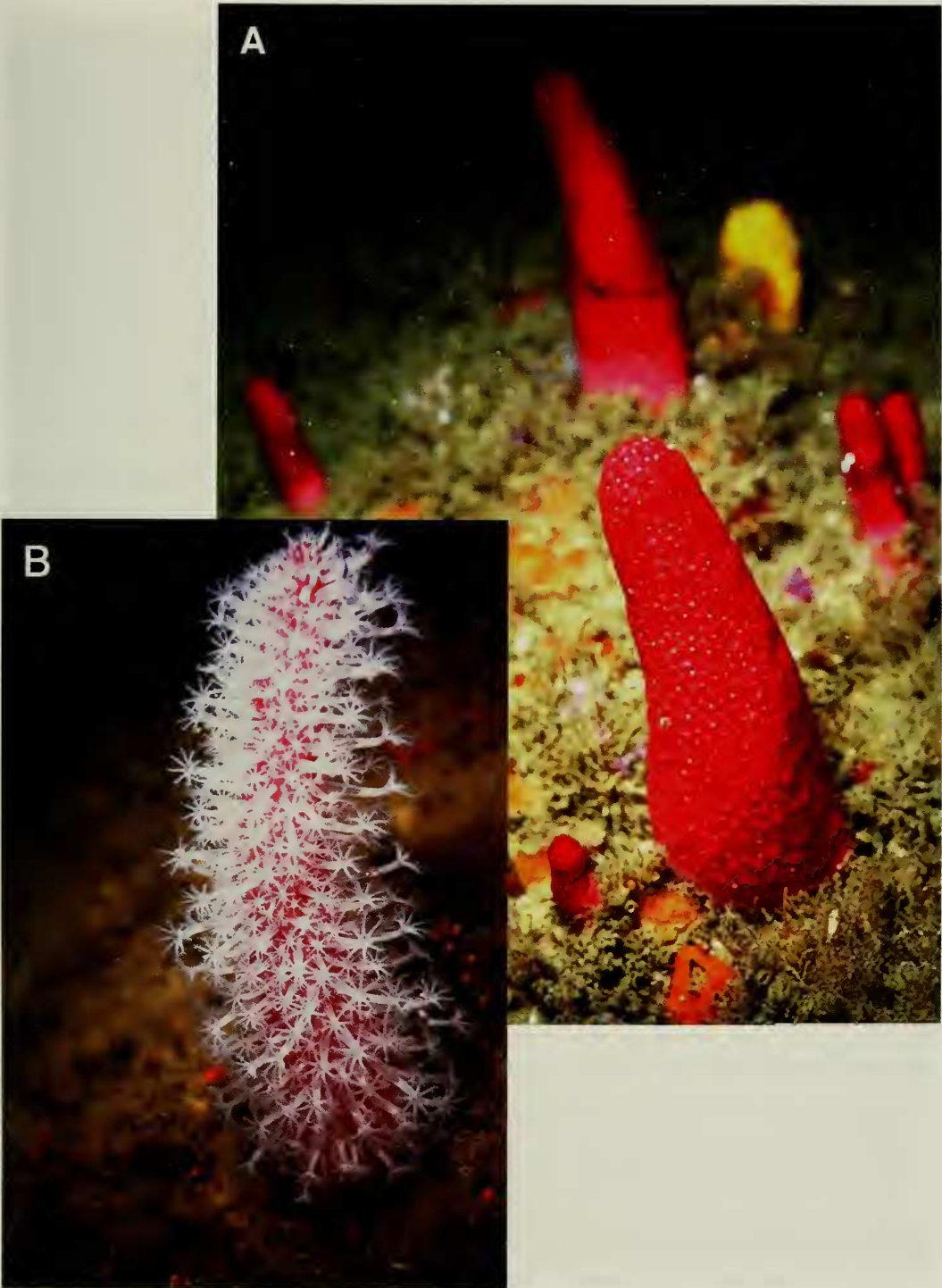


FIGURE 3. *Eleutherobia vinadigitaria* sp. nov. Living soft corals. A. Several colonies with polyps retracted (Photograph by Michael Schleyer). B. A single colony with polyps expanded (Photograph by Michael Schleyer).



FIGURE 4. *Eleutherobia vinadigitaria* sp. nov. Micrographs of surface region of paratype; longitudinal section of polypary. A. A single retracted polyp showing chevroned arrangement of needle-like sclerites in polyp wall, and thin layer of sclerites of mostly radiates in the surface coenenchyme. B. Three adjacent polyps. Scale bars each represent 1.0 mm. Abbreviations: cs – coenenchymal sclerites, gc – gastric cavity, ic – interior coenenchyme, p – points of enchevroned needle-like sclerites, rp – retracted polyp, sc – surface coenenchyme.

face of the polypary varies from 0.3 to 0.8 mm in diameter (Fig. 2D). Observation of living non-type material at the type locality shows that the polyps are generally retracted in bright daylight (Fig. 3A) and are expanded in early hours of the morning (Fig. 3B) (M. H. Schleyer, pers. comm.). Polyp sclerites are arranged in eight longitudinal rows along the ridges of the polyp walls, relatively sparsely placed. In some polyps, the sclerites may be disposed in a chevroned fashion, forming eight points.

Sclerites. Sclerites from the polyp body walls are needle-like spindles, mostly with tuberculation restricted to the opposite margins, as the flattened faces of the sclerites are for the most part smooth and devoid of ornamentation (Figs. 6A, 7A-B, 8A). They vary in length from 0.17 to 0.30 mm. Sclerites are lacking in the tentacles and pinnules. Coenenchymal sclerites are restricted to a very thin surface layer of the polypary and stalk (Fig. 4B). Sclerites of the surface of the polypary, as well as the bases of the polyps, are radiates and spindles (0.03–0.20 mm in length). Some of the spindles may be somewhat club-shaped (Fig. 6B, 10B). Sclerites from the surface of the stalk and holdfast are radiates (0.05–0.11 mm in length). Sclerites are altogether absent from the interior of the colonies.

Color. The interior of the wet-preserved holotype is cream colored to pale yellow (Fig. 2C), but crisp white in life (M. H. Schleyer, pers. commun.). The polyps are white to cream white (Fig. 3B). The color of the coenenchymal sclerites varies from deep red (Fig. 2E) to pale red, while the polyp sclerites vary from pale red to colorless.

INTERNAL ANATOMY OF THE PARATYPE.—The paratype specimen was cut longitudinally to reveal aspects of internal anatomy (Figs. 2C; 4A, B). The mature polyps have gastric cavities that extend throughout the entire length of the colony (Fig. 2C). The surface coenenchyme containing sclerites is

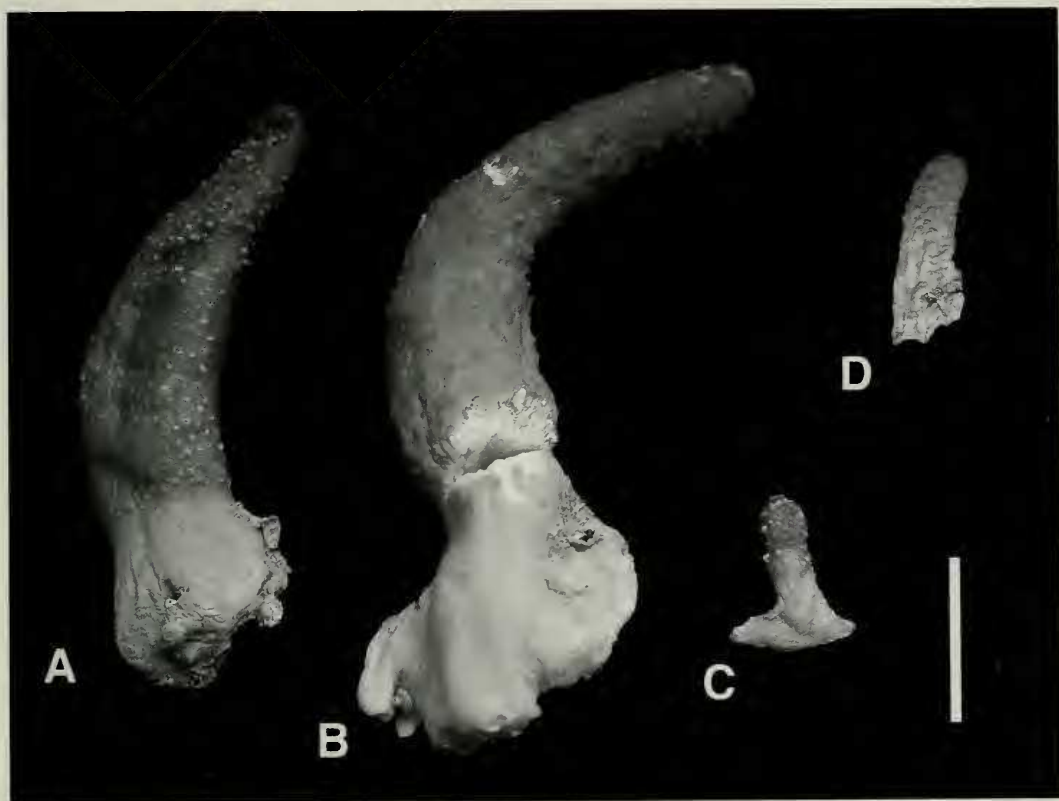


FIGURE 5. *Eleutherobia vinadigitaria* sp. nov. Variation in colony shape and size (non type material, wet preserved). A. SAM-H4835, 72 mm length. B. SAM-H4835, 100 mm. C. SAM-H4835, 18 mm. D. SAM-H792, 20 mm. Scale bar = 20 mm.

very thin, mostly < 0.2 mm in thickness (Fig. 4). The interior coenenchyme is firm but lacks sclerites (Fig. 4B). Conspicuous points formed by enchevroned sclerites from the polyp walls of the anthocodial neck zones can clearly be observed. However, transversely disposed sclerites forming a distinctive crown are lacking or at most are very sparsely distributed below the points (Fig. 4A).

ETYMOLOGY.—The specific epithet of the new species is derived from the Latin, *vinum* (wine), *digitus* (a finger), and the suffix, *-aria* (like); in reference to the wine red, finger-shaped colonies of this species of soft coral.

DISTRIBUTION.—The new species is known only from two localities in KwaZulu-Natal, South Africa (Fig. 1).

VARIATION.—The six available specimens range in size from 18–100 mm in length. The polypary comprises approximately 50–80% of the total colony length (Figs. 2, 5). The stalk and the polypary are approximately equal in length in the smallest specimens (Fig. 5C, D).

DISCUSSION

The rachises of the larger specimens of *Eleutherobia vinadigitaria* sp. nov. have retracted polyps exhibiting a variety of diameters (Fig. 2A, B, D). These all appear to be autozooids in various intermediate states of growth—each with eight equal-sized lappets closing over the opening of the retracted polyps, anthocodiae, and well-developed gastric cavities (Figs. 2C, 4B). In dimorphic taxa such as the

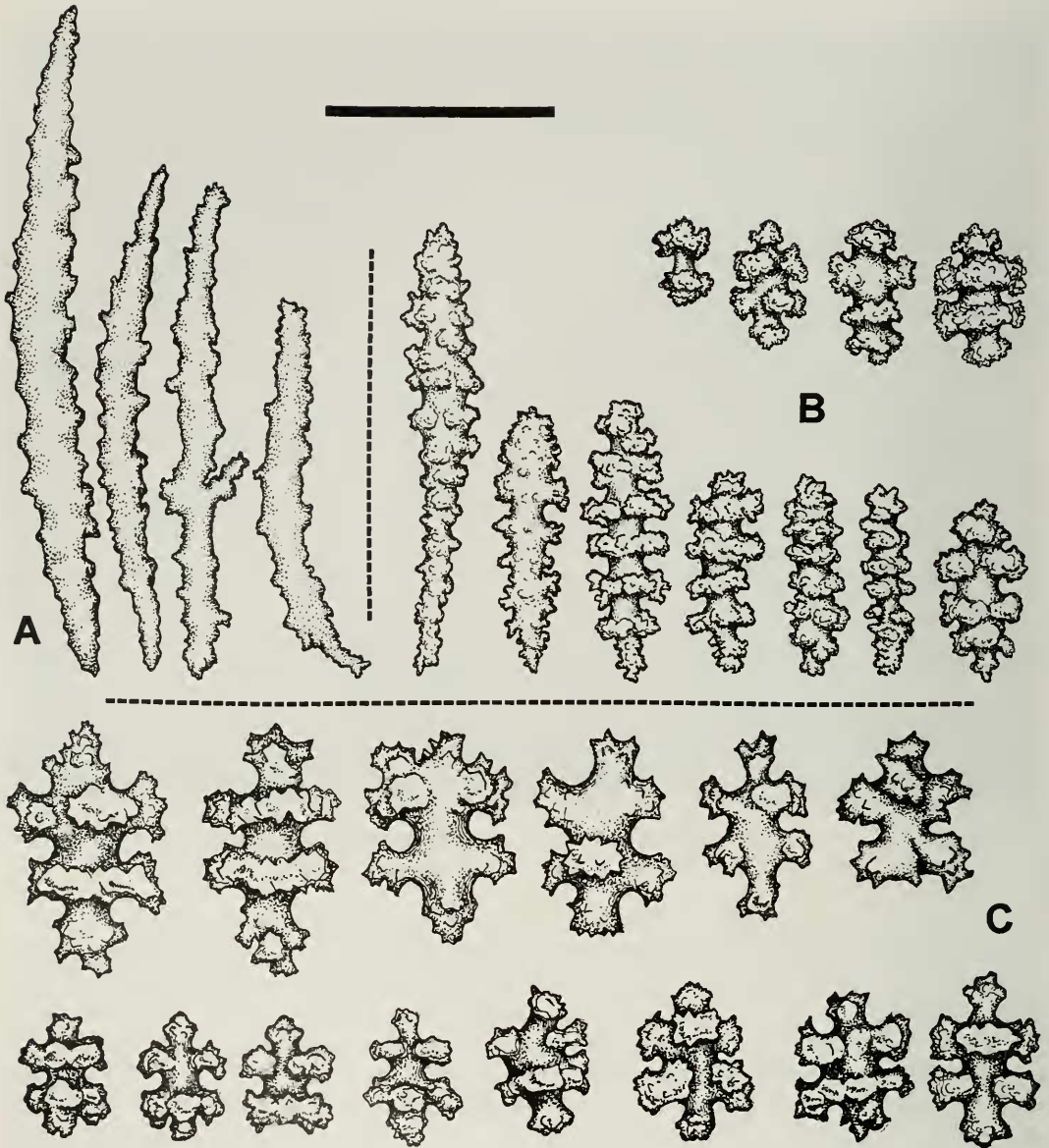


FIGURE 6. *Eleutherobia vinadigitaria* sp. nov., holotype. Variation in sclerite shape and size. A. Sclerites from the polyp walls. B. Coenenchymal sclerites from the surface of the polypary. C. Coenenchymal sclerites from the surface of the holdfast region of the stalk. Scale bar = 0.10 mm.

various species of the superficially similar soft coral genus *Paraminabea* Williams and Alderslade, 1999, the siphonozooids and autozooids display two distinct sizes without intermediates (Williams 1992b; Williams and Alderslade 1999). An additional aspect of distinction between the two genera is as follows: *Eleutherobia vinadigitaria* sp. nov., as in most other species of the genus, has distinctive longitudinal rows of needle-like sclerites in the neck zone of the anthocodiae (often enchevroned), while all species of *Paraminabea* apparently lack polyp sclerites (Fabricius and Alderslade, in press; Williams 1992b; Williams and Alderslade 1999).

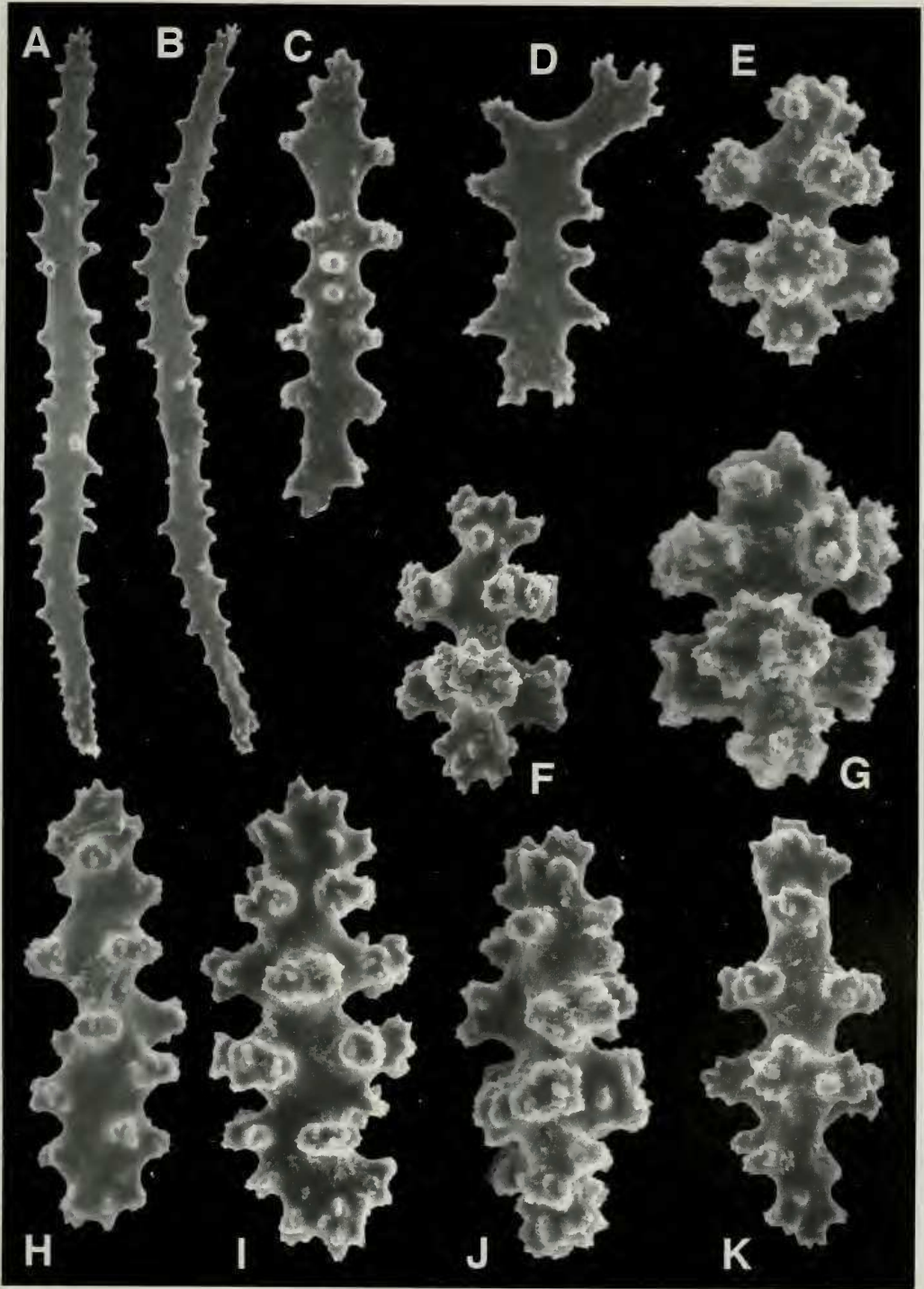


FIGURE 7. *Eleutherobia vinadigitaria* sp. nov. Scanning electron micrographs of sclerites from the holotype. A-B. Sclerites from the polyp walls, each 0.27 mm. C-K. Coenenchymal sclerites from the surface of the polypary and polyp bases. C. 0.09 mm. D. 0.07 mm. E. 0.05 mm. F. 0.06 mm. G. 0.05 mm. H. 0.08 mm. I. 0.09 mm. J. 0.06 mm. K. 0.08 mm.

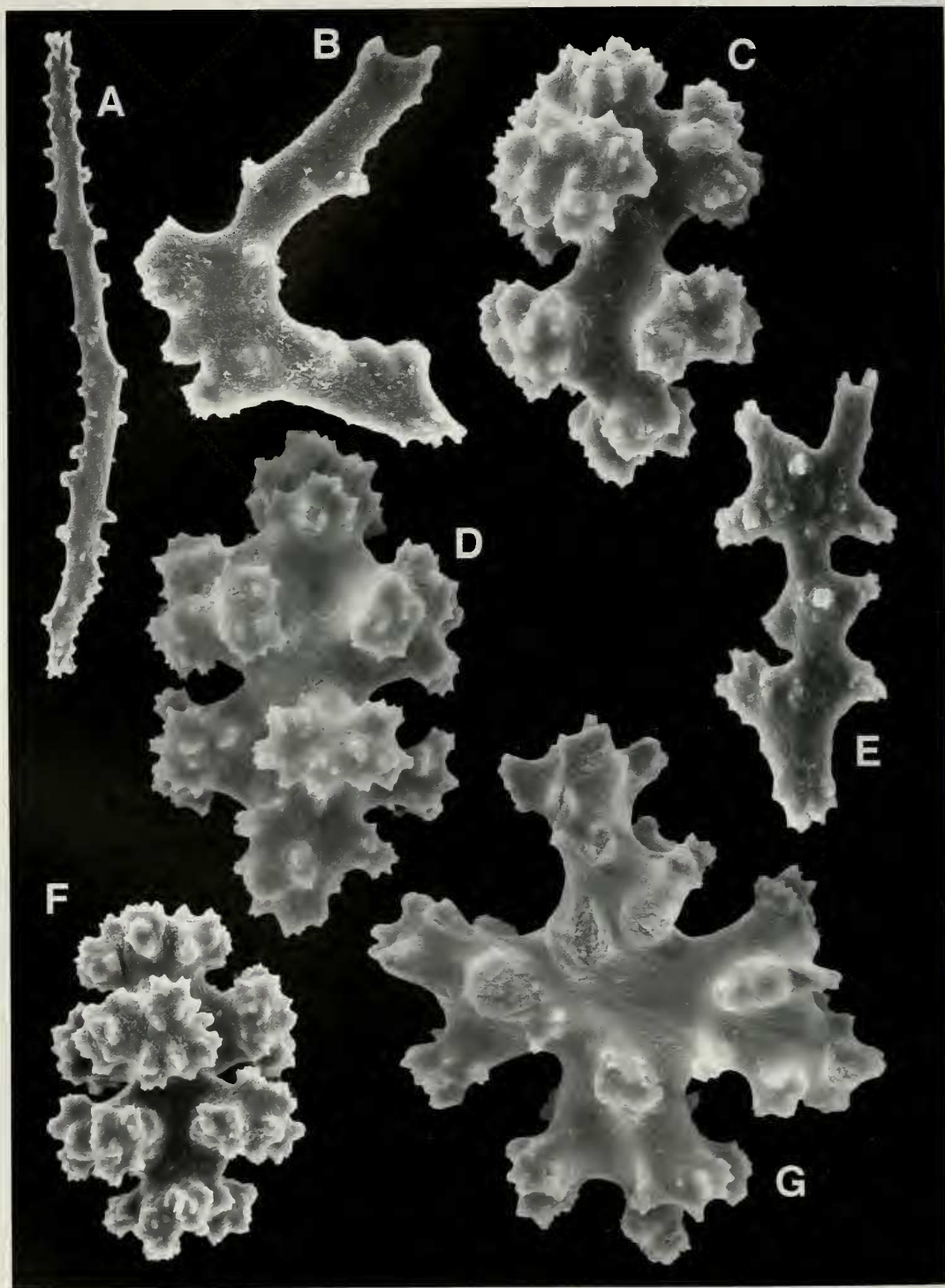


FIGURE 8. *Eleutherobia vinadigitaria* sp. nov. Scanning electron micrographs of sclerites from the holotype. A. A polyp wall sclerite, 0.20 mm. B–G. Coenenchymal sclerites from the surface of the polypary and polyp bases. B. 0.04 mm. C. 0.04 mm. D. 0.06 mm. E. 0.05 mm. F. 0.05 mm. G. 0.07 mm.

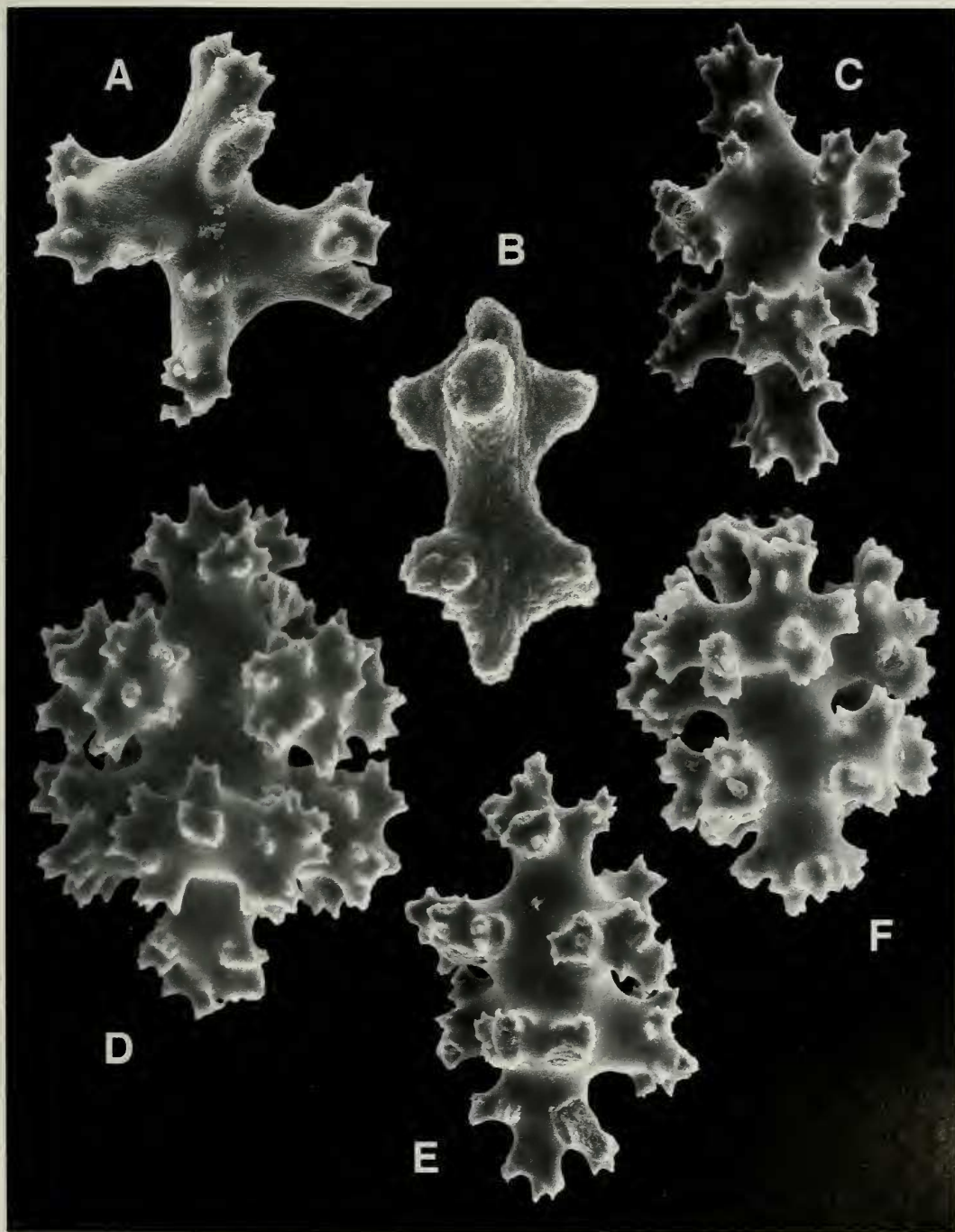


FIGURE 9. *Eleutherobia vinadigitaria* sp. nov. Scanning electron micrographs of coenenchymal sclerites from the surface of the stalk of the holotype. A. 0.05 mm. B. 0.01 mm. C. 0.10 mm. D. 0.03 mm. E. 0.09 mm. F. 0.05 mm.

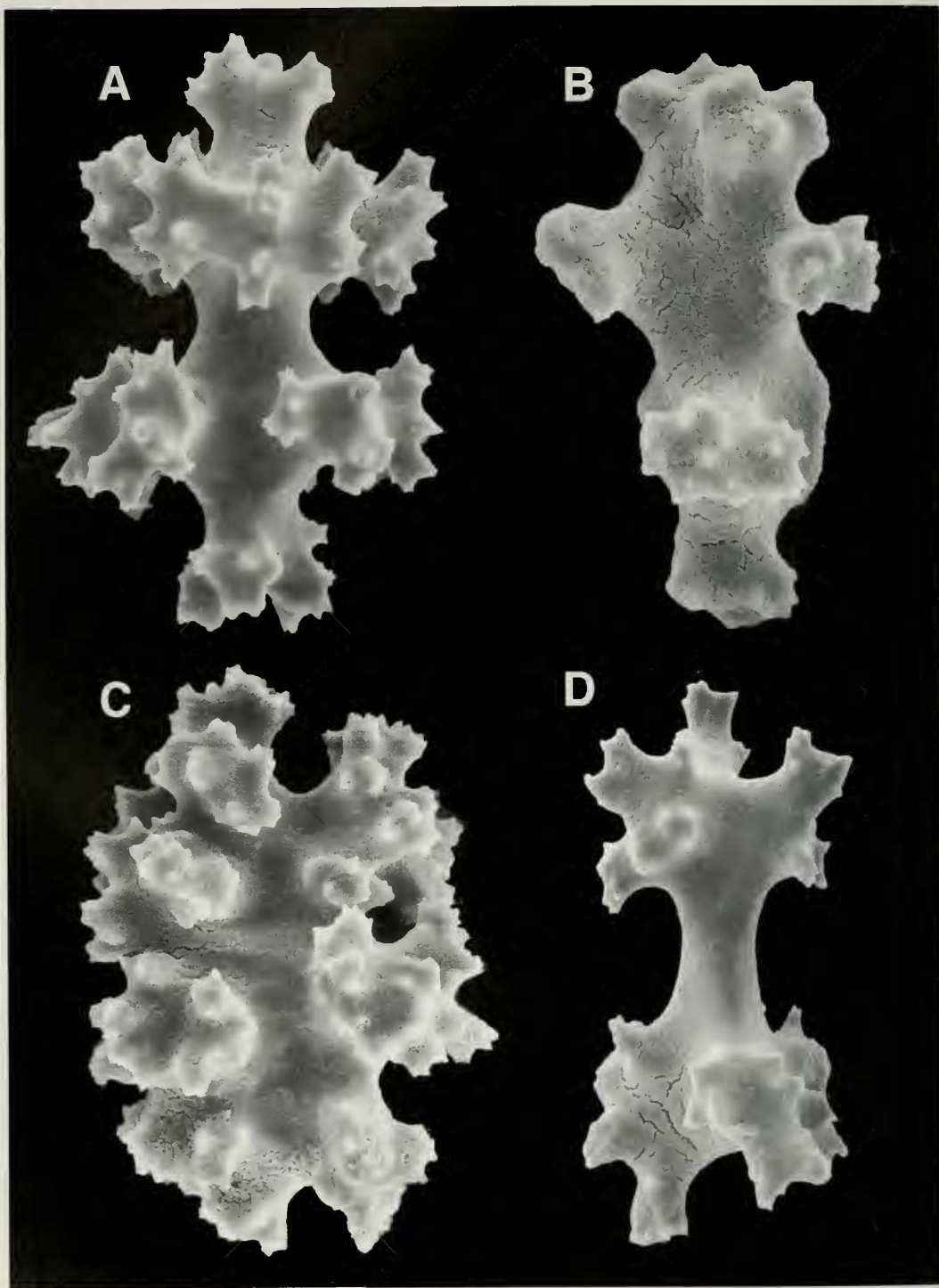


FIGURE 10. *Eleutherobia vinadigitaria* sp. nov. Scanning electron micrographs of coenenchymal sclerites from the surface of the stalk of the holotype. A. 0.07 mm. B. 0.06 mm. C. 0.06 mm. D. 0.09 mm.

Eleutherobia vinadigitaria sp. nov. superficially resembles *Eleutherobia rubra* (Brundin, 1896) from Japan and northwestern Australia (compare Figs. 1 and 3 with Verseveldt and Bayer 1988, fig. 32e–h). However, *Eleutherobia rubra* can be differentiated from the new species by the following characters: well-developed crown and points with densely set sclerites in the anthocodiae, sclerites in the tentacles, and highly ornamented polyp wall spindles with elongated tubercles (Verseveldt and Bayer 1988, figs. 30–31). *Eleutherobia vinadigitaria* sp. nov., on the other hand, has weakly developed points (without the development of a crown), lacks tentacle sclerites, and has polyp wall sclerites that are sparsely ornamented spindles with low tubercles.

Eleutherobia aurea Benayahu and Schleyer (1995), also from Natal, South Africa, is similar in colony shape to *Eleutherobia vinadigitaria* sp. nov., but differs by having bright yellow coloration, a lack of polyp sclerites, and coenenchymal sclerites that are compact radiates and spheroids.

ACKNOWLEDGMENTS

We express our gratitude to Yehuda Benayahu (Tel Aviv University, Tel Aviv), Michael Schleyer (Oceanographic Research Institute, Durban), Leen van Ofwegen (National Museum of Natural History, Leiden), Phil Alderslade (Museum and Art Gallery of the Northern Territory, Darwin), and Alan Leviton, Katie Martin, and Marilyn Eversole (California Academy of Sciences, San Francisco) for their support, suggestions, and comments.

This paper is a result of a collaborative effort during the 1997 (June through August) Summer Systematics Institute, California Academy of Sciences, San Francisco.

LITERATURE CITED

- BENAYAHU, Y. AND M. H. SCHLEYER. 1995. Corals of the south-west Indian Ocean II. *Eleutherobia aurea* spec. nov. (Cnidaria, Alcyonaria) from deep reefs on the KwaZulu-Natal Coast, South Africa. South African Association for Marine Biological Research, Oceanographic Research Institute, Investigational Report 68:1–12.
- FABRICIUS, K. AND P. ALDERSLADE. In press. Soft corals and sea fans—a comprehensive guide to the tropical shallow water genera of the central-west Pacific, the Indian Ocean and the Red Sea. Australian Institute of Marine Science, Townsville.
- GRAY, J. E. 1835. Characters of a new genus of corals (*Nidalia*). Proceedings of the Zoological Society of London 3:59–60.
- . 1862. Description of two new genera of zoophytes (*Solenocaulon* and *Bellonella*) discovered on the north coast of Australia by Mr. Rayner. Proceedings of the Zoological Society of London 1862:34–37.
- PFEFFER, G. 1889. Zur Fauna von Sud-Georgien. Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten 6(2):49–55.
- PÜTTER, A. 1900. Alcyonaceen des Breslauer Museum. Zoologische Jahrbücher (Systematik) 13(5):443–462.
- THOMSON, J. A. AND L. M. I. DEAN. 1931. The Alcyonacea of the Siboga Expedition with an addendum to the Gorgonacea. Siboga Expedition Monographs 13d:1–227.
- THOMSON, J. S. 1910. The Alcyonaria of the Cape of Good Hope and Natal. Alcyonacea. Transactions of the Royal Society of Edinburgh 47(3):549–589.
- VERSEVELDT, J. AND F. M. BAYER. 1988. Revision of the genera *Bellonella*, *Eleutherobia*, *Nidalia* and *Nidaliopsis* (Octocorallia: Alcyoniidae and Nidaliidae), with descriptions of two new genera. Zoologische Verhandelingen 245:1–131.
- WILLIAMS, G. C. 1992a. The Alcyonacea of southern Africa. Stoloniferous octocorals and soft corals (Coelenterata, Anthozoa). Annals of the South African Museum 100(3):249–358.
- . 1992b. Revision of the soft coral genus *Minabea* (Octocorallia: Alcyoniidae) with new taxa from the Indo-West Pacific. Proceedings of the California Academy of Sciences 48(1):1–26.
- . 1996. Octocorallia – Octocorals. Pp. 32–60 in Coral reef animals of the Indo-Pacific—animal life from Africa to Hawai'i exclusive of the vertebrates, T. M. Gosliner, D. W. Behrens, and G. C. Williams. Sea Challengers, Monterey. 314 pp.

- . 2000a. Two new genera of soft corals (Anthozoa: Alcyoniidae) from South Africa, with a discussion of diversity and endemism in the southern African octocorallian fauna. *Proceedings of the California Academy of Sciences* 52(6):65–75.
- . 2000b. A new species of the soft coral genus *Eleutherobia* Pütter, 1900 (Coelenterata: Alcyonacea) from the Tonga Islands. *Proceedings of the California Academy of Sciences* 52(13):159–169.
- WILLIAMS, G. C. AND P. ALDERSLADE. 1999. Revisionary systematics of the western Pacific soft coral genus *Minabea* (Octocorallia: Alcyoniidae), with descriptions of a related new genus and species from the Indo-Pacific. *Proceedings of the California Academy of Sciences* 51(7):337–364.